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# (54) A method of processing audio information

(57) Stereo audio signals are processed by filtering low-frequency signals from each channel in a low-pass filter 10, amplifying the low-frequency signals at 12, and adding the resulting signal to the opposite channel. It has been found that this eliminates or reduces low-frequency noise caused by low-frequency vertical modulation, e.g. record warpage.

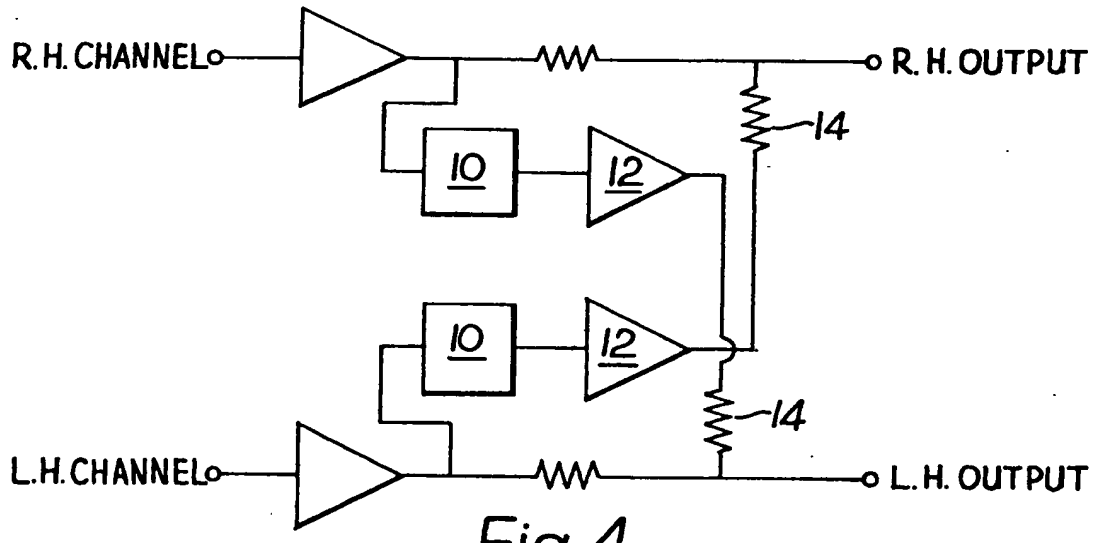


Fig. 4

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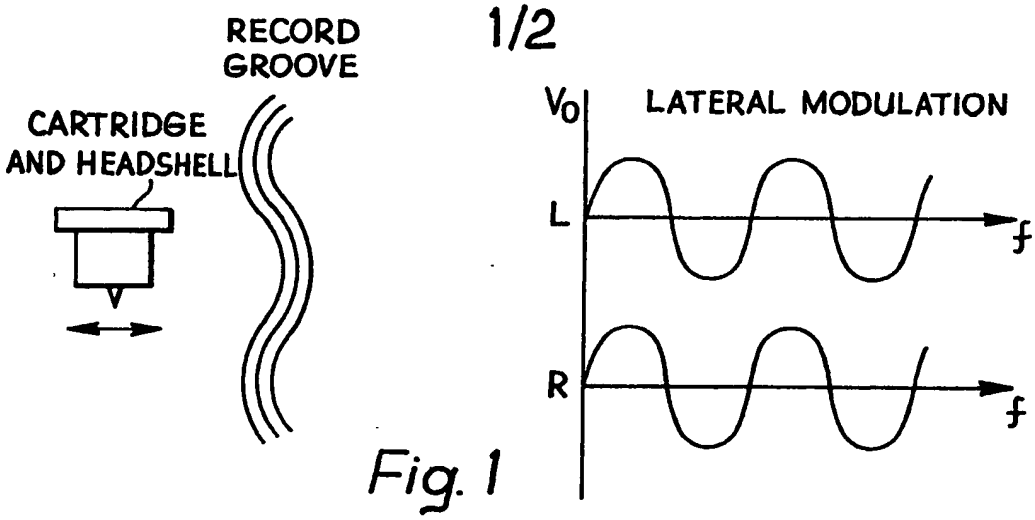


Fig. 1

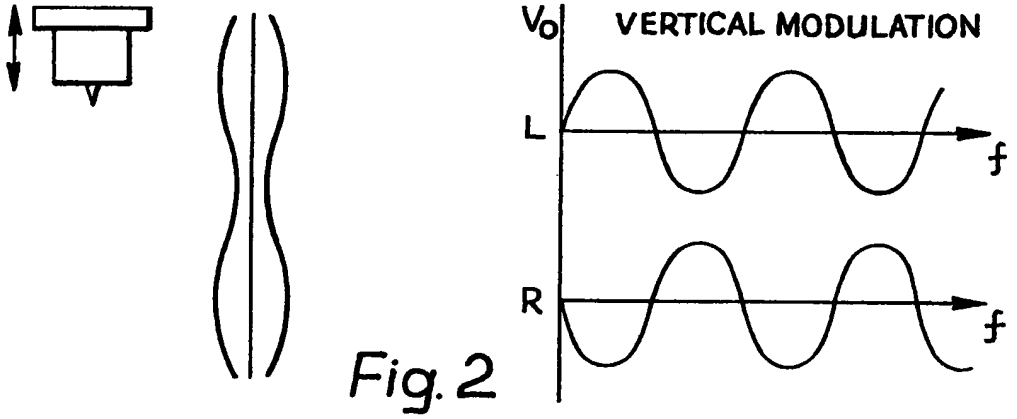


Fig. 2

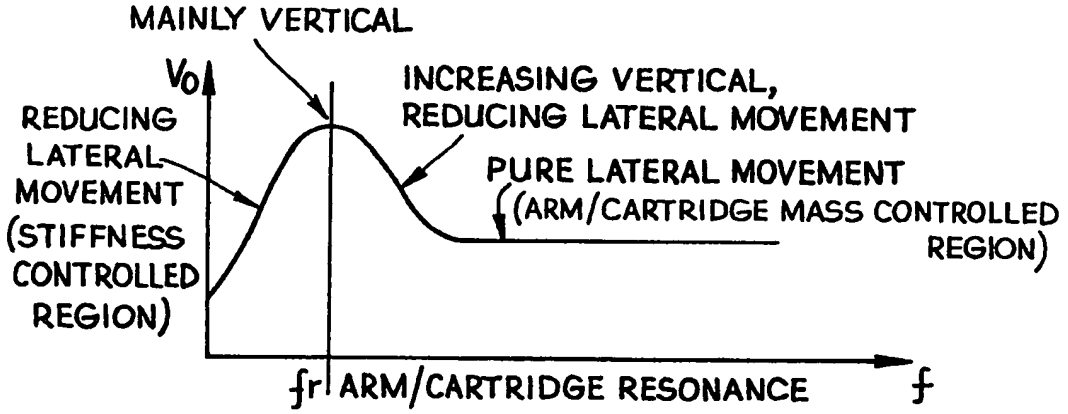


Fig. 3

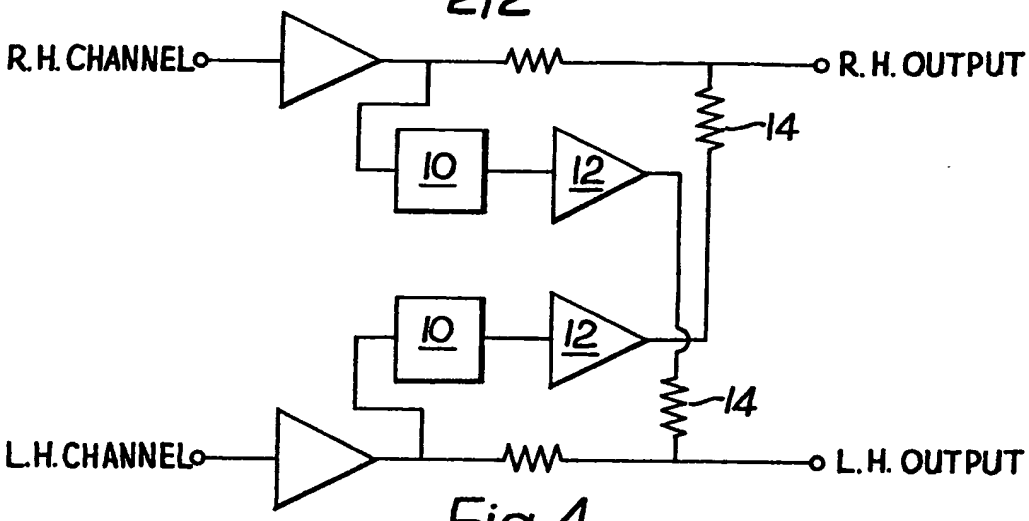


Fig. 4

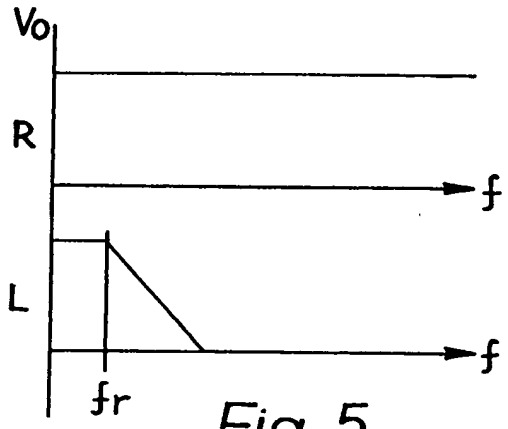


Fig. 5

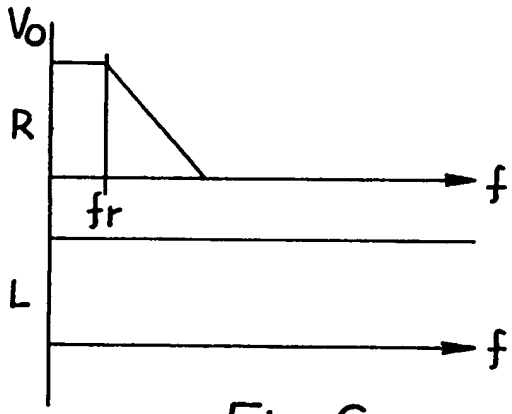


Fig. 6

SPECIFICATION

**A method of processing audio information**

The present invention relates to the processing of audio information.

Generally, when a recorded disc is being played on a turntable the desired audio information subjects cartridge and headshell to lateral modulation as the stylus follows the groove of the disc. However, they are also subject to vertical modulation, i.e. up and down movement at low frequency, in the stiffness controlled region due to record warpage and other effects. It is desirable to remove this low frequency noise from the audio output, and this is usually achieved by using a high pass filter to cut off the low frequency components. However this cuts off the wanted low frequency components as well as the unwanted low frequency components. Although the audio spectrum for the human ear extends from 20Hz to 20KHz, there are frequency components below 20Hz which enhance the sound quality perceived by the listener.

It is an object of the present invention to mitigate or obviate the aforesaid disadvantage.

The invention is based on the realisation that the wanted low frequency audio information is in-phase in the left and right hand channels, while the unwanted low-frequency noise is substantially antiphase.

The present invention accordingly provides a method of processing audio information by cross-feeding the low frequency components of the right hand and left hand channel output signals from a stereo cartridge in order to eliminate unwanted low frequency components and maintain the wanted low frequency components.

From another aspect the present invention provides apparatus for processing right hand and left hand audio information from a stereo cartridge, the apparatus comprising signal paths including low-pass filter means from the right hand channel to the left hand channel and vice versa, such that the substantially out of phase output signals due to vertical modulation are eliminated and the substantially in phase output signals due to lateral modulation are added.

Preferably, said means comprises a low pass filter, an amplifier and a resistor connected in series between the right hand channel output and the left hand channel output and a low pass filter, an amplifier and a resistor connected in series between the left hand channel output and the right hand channel output.

An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings; in which:—

*Figure 1* shows the right hand and left hand channel output responses due to lateral modulation;

*Figure 2* shows the right hand and left hand channel output responses due to vertical modulation;

*Figure 3* shows the combined output response of both channels;

*Figure 4* shows a schematic diagram of the apparatus according to the present invention; and

*Figures 5 and 6* show the right hand and left hand channel output responses after the audio information has been processed according to the present invention.

With reference to Fig. 1, as the stylus follows a record groove it is subject to lateral modulation. This this side to side oscillation produces RH and LH channel output signals as shown in Fig. 1. These output signals are in phase with each other and are predominant above the arm/cartridge resonant frequency of approximately 10Hz (Fig. 3).

The output signals due to lateral modulation contain low frequency components which are of interest.

With reference to Fig. 2, the stylus and corresponding cartridge and headshell are also subject to vertical modulation. This up and down movement produces RH and LH channel output signals as shown in Fig. 2. These output signals are out of phase with each other and produce distortion at the loudspeaker. It is therefore desirable to eliminate the low frequency components due to vertical modulation.

With reference to Fig. 5, the apparatus for processing audio information according to the present invention comprises a low pass filter 10, an amplifier 12 and a resistor 14 connected in series between the RH channel output and the LH channel output and similarly between the LH channel output and the RH channel output.

The output signals from each channel are therefore cross-fed and therefore added. The out of phase signals due to vertical modulation are effectively eliminated and the in phase signals due to lateral modulation are increased.

This is represented by the voltage/frequency characteristics of Figs. 5 and 6.

CLAIMS

1. A method of processing audio information by cross-feeding the low frequency components of the right hand and left hand channel output signals from a stereo cartridge in order to eliminate unwanted low frequency components and maintain the wanted low frequency components.

2. Apparatus for processing right hand and left hand audio information from a stereo cartridge, the apparatus comprising signal paths including low-pass filter means from the

right hand channel to the left hand channel and vice versa, such that the substantially out of phase output signals due to vertical modulation are eliminated and the substantially in phase output signals due to lateral modulation are added.

3. Apparatus for processing right hand and left hand audio information from a stereo cartridge, in which said means comprises a low pass filter, an amplifier and a resistor connected in series between the right hand channel output and the left hand channel output and a low pass filter, an amplifier and a resistor connected in series between the left hand channel output and the right hand channel output.

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